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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,673	02/05/2004	Jan Kuzmik	K1-02US1	5601

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EXAMINER	
MONDT, JOHANNES P	

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 01/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/772,673	KUZMIK, JAN	
	Examiner	Art Unit	
	Johannes P Mondt	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 October 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *08/06/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of the Species corresponding to Figure 5 in Applicant's Specification in the reply filed on 10/18/2004 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). It is acknowledged, however, that Applicant states that all claims read on the elected Species.

Information Disclosure Statement

The examiner has considered all items listed in the Information Disclosure Statement. A signed copy of Form PTO-1449 is being enclosed in this office action.

Drawings

2. ***Figures 1-3*** should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.121(d)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. ***Claims 1-3, 5, 6, 8, 9, 11, 13, 22, 23 and 25-30*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art by Applicant (APAA) in view of Kim et al (Applied Physics Letters 71(6), 800-802 (1997)).

On claims 1, 2 and 23: APAA teaches (Figure 3 and section [0009]) a hetero-interface field effect transistor comprising:

a substrate (cf. Figure 3); and

a cation-polarity layered structure including at least a barrier layer 43 and a channel layer 42.

APAA does not teach said barrier layer to include $In_xAl_{1-x}N$ with x being in the range $0 \leq x \leq 0.3$. However, it would have been obvious to include $In_xAl_{1-x}N$ in said barrier layer in view of the specific teaching by Kim et al, who specifically teach the selection of $In_xAl_{1-x}N$ as a superior material for a heterojunction barrier layer abutting GaN in inter alia high electron mobility transistors (cf. title, abstract and page 802, first column, central paragraph) because of an achievable band-gap energy difference with the abutting GaN layer of at least 670 meV (loc.cit.) (for a lattice-matched system, portending higher mobility due to fewer scattering centers) and as high as 970 meV (loc.cit.) for x=0.17 (*claim 2*). The value of the stoichiometric parameter in the prior art is

preferably x=0.08, which overlaps with the range as claimed, or x=0.17. Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003). *Motivation* to include the teaching by Kim et al in the APAA at least directly connects to the high band-gap energy jump at the interface, thus increasing the density of electrons confinable (loc.cit.).

Finally, *claim 23* merely states that the device of claim 1 would necessarily have to be formed in order to function. Claim 23 fails to further limit the device of claim 1 other than simply form each of their components.

On claims 3, 6, 9, 27 and 30: said channel 42 includes GaN (cf. section [0009]).

On claim 5 and 29: said barrier includes $In_xAl_{1-x}N$, x being in the range as given by $0 \leq x \leq 0.17$ (cf. Kim et al, page 802, central paragraph of first column).

On claim 8: said barrier layer by Kim et al has x in the range that includes a limiting point of the ranger as claimed, namely: x=0.17. This value is not part of the range as claimed, but is infinitesimally close to it. Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003). In the underlying case, one skilled in the art would expect an infinitesimal,

i.e., arbitrarily small, increase in the stoichiometric parameter x not to change the properties of the transistor other than by an arbitrarily small, hence insignificant amount.

On claim 11: while neither the APAA nor Kim et al necessarily teach the further limitation as defined by this claim, Applicant in his disclosure does not explain why the range as claimed is critical to his invention. With regard to said range, reference is only made to the relative advantage over AlGaN barriers (cf. section [0069]). Applicant does not explain why the difference between the claimed range ($0.25 < x < 0.30$) and the range taught in the prior art (which at least contains $x=0.17$) is critical to his invention. In view of the absence of a teaching why a range is critical to the invention Applicant is reminded that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

On claims 13 and 22: APAA teaches (Figure 3 and section [0009]) a hetero-interface field effect transistor comprising:

a substrate (cf. Figure 3); and

a layered QW structure (section [0009]) including at least a barrier layer 43 and a channel layer 42 providing inherently a possibility to create a two-dimensional electron gas density.

APAA does not necessarily teach the limitation that said two-dimensional electron gas density is above $n_{total} = 1.1 \times 10^{13}\ cm^{-2}$.

However, it would have been obvious to include said limitation in view of the specific teaching by Kim et al, who specifically teach the selection of $In_xAl_{1-x}N$ as a

superior material for a heterojunction barrier layer abutting GaN in inter alia high electron mobility transistors (cf. title, abstract and page 802, first column, central paragraph) because of an achievable band-gap energy difference with the abutting GaN layer of at least 670 meV (loc.cit.) (for a lattice-matched system, portending higher mobility due to fewer scattering centers) and as high as 970 meV (loc.cit.) for x=0.17 which inherently creates the material conditions to generate a two-dimensional electron gas of density as claimed. The value of the stoichiometric parameter in the prior art is preferably x=0.08, which overlaps with the range as claimed, or x=0.17. Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003).

Motivation to include the teaching by Kim et al in the APAA at least directly connects to the high band-gap energy jump at the interface, thus increasing the density of electrons confinable (loc.cit.).

Finally, claim 22 merely states that the device of claim 13 would necessarily have to be formed in order to function. Claim 22 fails to further limit the device of claim 22 other than simply form each of their components.

On claim 25: the claimed method is merely implied by a method of using the invention as described by APAA in any electronic device comprising any electronic circuit: the hetero-interface field effect transistor of Figure 3 has a substrate (cf. Figure

3); and a layered QW structure (cf. section [0009]) including at least a barrier layer 43 and a channel layer 42 providing a polarization-induced charge (inherent spontaneous polarization ΔP_0 (cf. section [0010]). The mere presence of source, gate and drain already implies both an electronic circuit and an electronic device. Therefore, the claimed method is obvious over the device as claimed for instance by claim 13.

On claim 26: the claimed method is merely implied by a method of using the invention as described by APAA in any electronic device: the hetero-interface field effect transistor of Figure 3 comprises a substrate (cf. Figure 3); and a layered QW structure (cf. section [0009]) including at least a barrier layer 43 and a channel layer 42 providing a polarization-induced charge (inherent spontaneous polarization ΔP_0 (cf. section [0010]). The mere presence of source, gate and drain already implies both an electronic device. Therefore, the claimed method is obvious over the device as claimed for instance by claim 13.

5. ***Claims 14, 15, 20, 21 and 24*** are rejected under 35 U.S.C. 103(a) as being unpatentable over APAA and Kim et al as applied to claims 1 and 13 above, and further in view of Tateno (6,242,766 B1). As detailed above, claims 1 and 13 are unpatentable over APAA in view of Kim et al. *Neither necessarily teach* the further limitations as defined by any of claims 14, 15, 20 and 21. *However, it would have been obvious* to include said limitations in view of Tateno, who, in a patent on a high electron mobility transistor (cf. title), - hence related art, teaches the application of HEMTS to portable telephone, satellite broadcasting, communication systems, and satellite communication systems for the specific purpose of achieving high power at ultra-high frequency (col. 1,

l. 10-22). *Motivation* to include the teaching by Tateno in the invention as described by APAA thus simply derives from applying the transistor by APAA to obvious applications, thus increasing the net return on investment by increasing the variety of applications of said invention.

Finally, claim 24 merely states that the device of claim 15 would necessarily have to be formed in order to function. Claim 24 fails to further limit the device of claim 15 other than simply form each of their components.

6. ***Claims 16 and 17*** are rejected under 35 U.S.C. 103(a) as being unpatentable over APAA and Kim et al as applied to claims 1 and 13 above, and further in view of Larson (5,554,865). *As detailed above, claims 1 and 13 are unpatentable* over APAA in view of Kim et al. *Neither necessarily teach* the further limitations of claims 16 or 17. *However, it would have been obvious* to include said further limitations in view of Larson, who, in a patent on a low noise amplifier for a radar system (cf. title and abstract), teach the selection of a high electron mobility transistor as the basis for the low noise amplifier because of the superior high frequency noise figure (e.g., 6 db at 58 GHz) (cf. col. 1, l. 6-64). *Motivation* to include the teaching by Larson in the invention as described by APAA derives from the obvious application of the HEMT as a superior low noise amplifier at high frequency, thus increasing the net return on investment by increasing the variety of applications of the invention.

7. ***Claim 18*** is rejected under 35 U.S.C. 103(a) as being unpatentable over APAA as applied to claim 1 and claim 13 above, and further in view of White (EP 0 606 776 A2). *As detailed above, claims 1 and 13 are unpatentable* over APAA in view of Kim et

al. *Neither necessarily teach the further limitation* of claim 18. *However, it would have been obvious to include* said further limitations in view of White, who, in a patent application on THz radiation and detection (title and abstract) teaches a HEMT circuit structure for sensing inter sub-band transitions as part of an optical sensor (cf. Figure 6 and column 7, l. 15-55). The teaching of a HEMT circuit for this purpose is obvious because high electron mobility transistors are superior low noise amplifiers at extremely high frequency such as THz. *Motivation* to include the teaching by White in the invention as described by APAA derives from the obvious application of the HEMT as a superior low noise amplifier at high frequency, thus increasing the net return on investment by increasing the variety of applications of the invention.

8. ***Claim 19*** is rejected under 35 U.S.C. 103(a) as being unpatentable over APAA and Kim et al as applied to claims 1 and 13 above, and further in view of Kawasaki (JP06339657A). *As detailed above, claims 1 and 13 are unpatentable* over APAA in view of Kim et al. *Neither necessarily teach the further limitation* of claim 19. *However, it would have been obvious to include* said further limitations in view of Kawasaki, who, in a patent application on the miniaturization of a microwave frequency converting circuit teaches the integration of an intermediate frequency amplifier in a HEMT monolithic integrated circuit (see English abstract, "Constitution") for the specific purpose of miniaturizing the entire circuit and reduce the number of different parts while keeping versatility (see English abstract, "Purpose"). *Motivation* to include the teaching by Kawasaki in the invention as described by APAA derives from the obvious application of a HEMT to a HEMT monolithic integrated circuit including IF amplifier in a microwave

frequency converting circuit as a known application of HEMT technology, thus increasing the net return on investment by increasing the variety of applications of the invention.

9. ***Claims 4, 7, 10, 12 and 28*** are rejected under 35 U.S.C. 103(a) as being unpatentable over APAA and Kim et al as applied to claims 2, 5, 8, 11 and 26 above, and further in view of Redwing et al (6,727,531 B1; cf. IDS). *As detailed in the above*, claims 2, 7, 8, 11 and 26 are unpatentable over APAA in view of Kim et al. *Neither necessarily* teach the further limitation as defined by claims 4, 7, 10, 12 or 28. *However, it would have been* obvious to include said further limitation in view of Redwing et al, who teaches the selection of InGaN as channel material for HEMT devices (cf. title and abstract) rather than GaN for the specific purpose inter alia of increasing the channel mobility with consequent device characteristics improvements (cf. col. 3, l. 4-8). *Motivation* to include the teaching by Redwing et al in the invention as described by APAA at least derives from said improvements.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JPM
January 8, 2005

Patent Examiner:

Johannes Mondt (Art Unit: 2826)